Bone Setup for Dragon

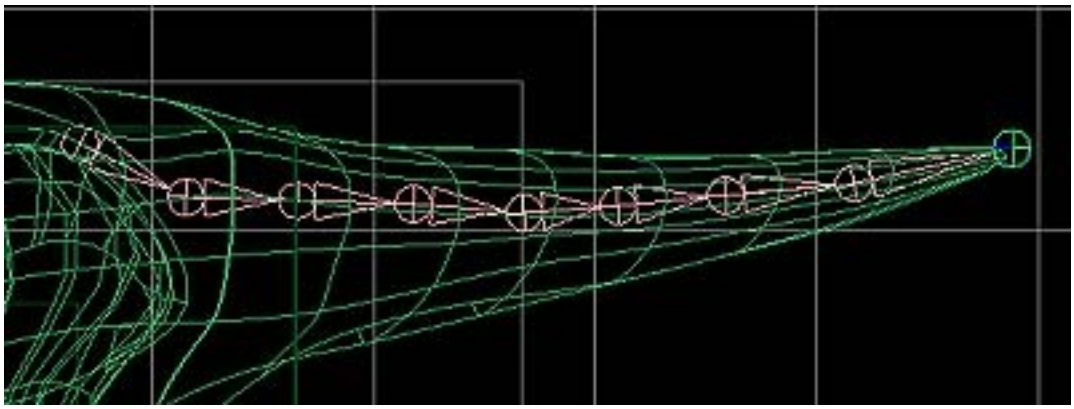
Hi, welcome back to my tutorial. This time I going to show you how I setup bone for the dragon in the ready to animate way. Before I write this article, I've been completed a shot animated sequence of the dragon. A lot of mistake I've made during the setup, bind skin and IK. Most of the mistake that I've made only will show up during the animation process. So, we got to learn from the mistake. Although this tutorial is not perfectly done, but I will try my best to share this with you.

1. Before you start, you got to plan for the bone's direction to get it into correct hierarchy. In this case, pelvis of the dragon should at the top of the hierarchy, that's mean pelvis is the parent of all bones.

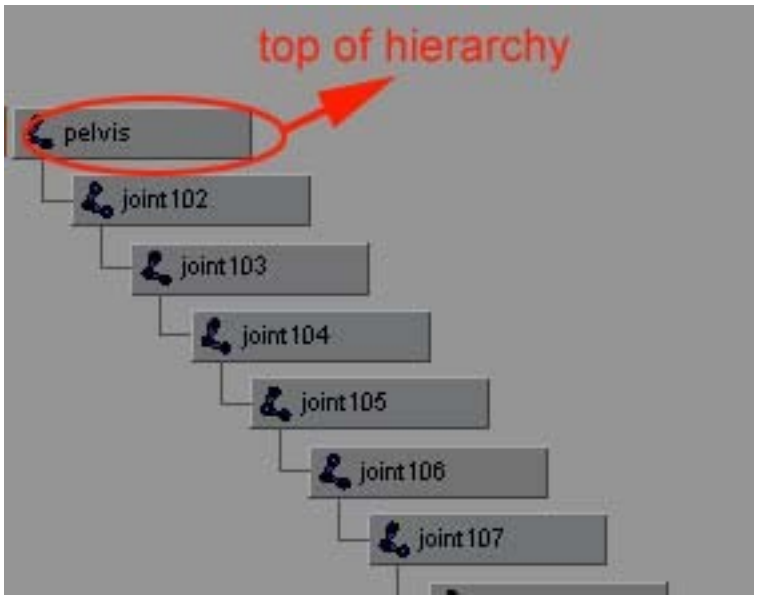
After decided the bone direction, I will start create the pelvis by using joint tool.

2. Create a new layer and name it "Bone" and label it to different colour. While the 'Bone' layer still selected, switch to Animation mode, go to top menu -> skeleton -> joint tool or select the joint tool icon from the shelf.

3. While the cursor changed into +, I start click on the pelvis location to create joint. Make a few clicks to
Create a tail. Press enters to complete the bone.

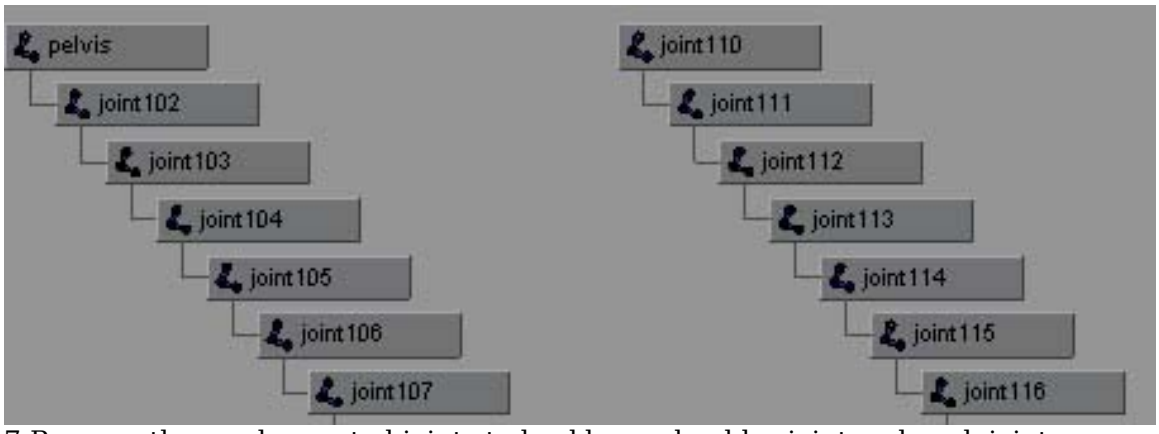


4. Go to hypergraph to locate the joints that u created, before you forget, renames the first joint to pelvis.
Pelvis should be on the top of the hierarchy.

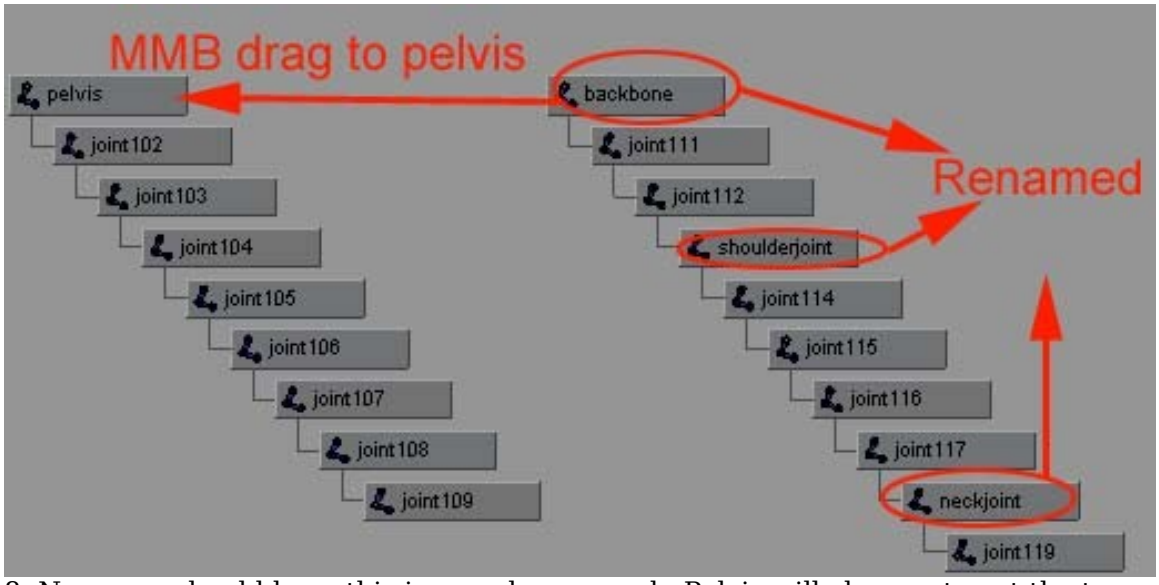


5. Press Y to return to previous tool, creates joints all the way from pelvis to the head, and beware to locate the neck joint to the right place. You can always adjust the bone later before u creates any IK handle.

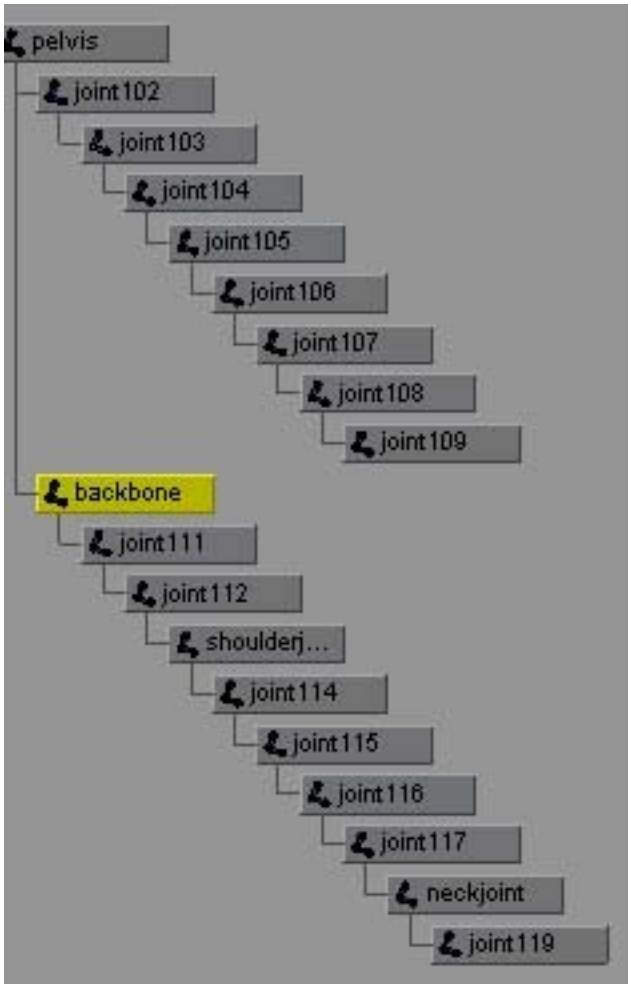
6 open the hypergraph and you will notice there are 2 set of joints.



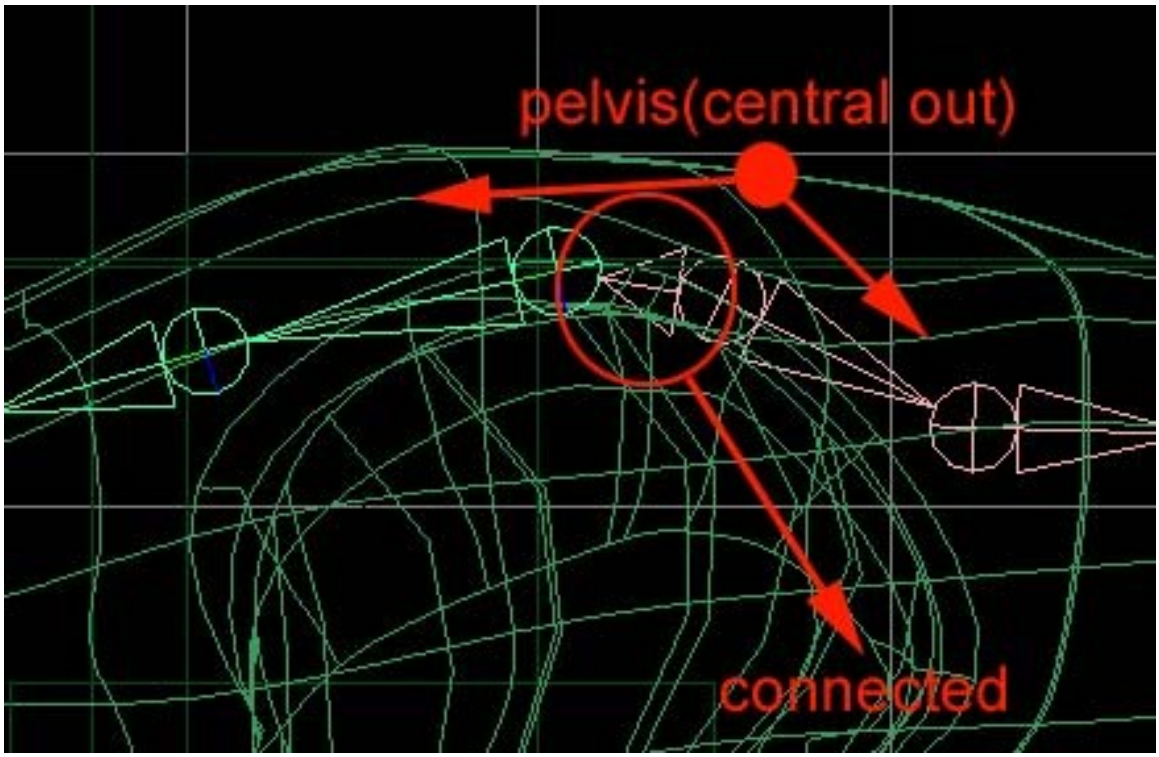
7.Rename the newly created joints to backbone shoulder joint and neck joint accordingly. Then, we got to parent the set 2 of bone to pelvis to become the dragon's backbone structure. To do this, you can either MMB drag the 2nd set of bone into pelvis or from the side view, select backbone structure (child), shift select the pelvis (parent) press P to parent. Either way will do.



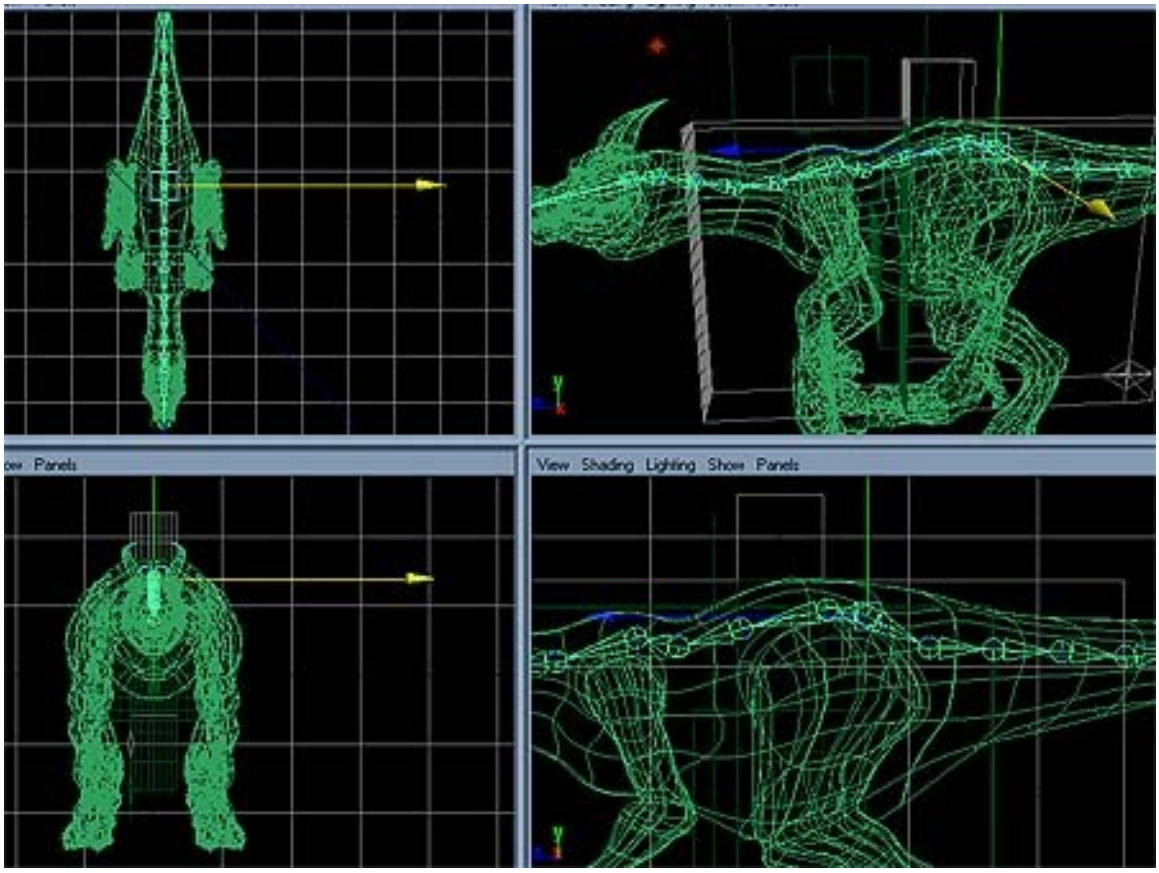
8. Now, you should have this in your hypergraph. Pelvis will always stay at the top of the hierarchy. If you not get it, something is wrong and u needs to check it out.



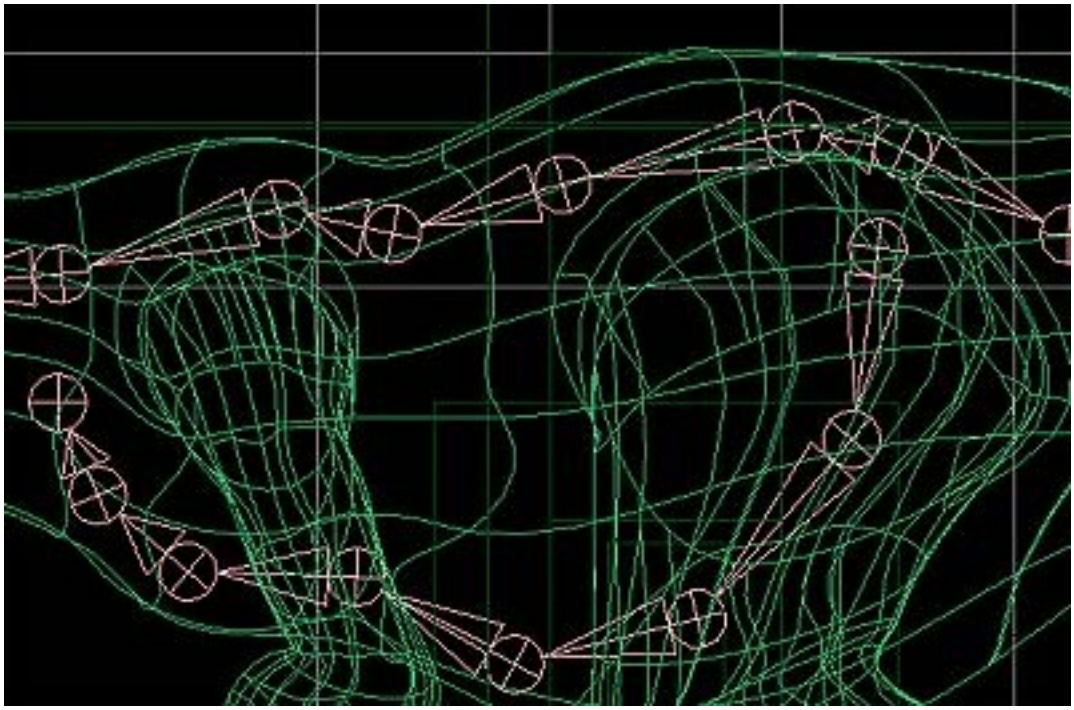
And you should get this in your side view: both sets are connected and the pelvis joint should be the central of them.



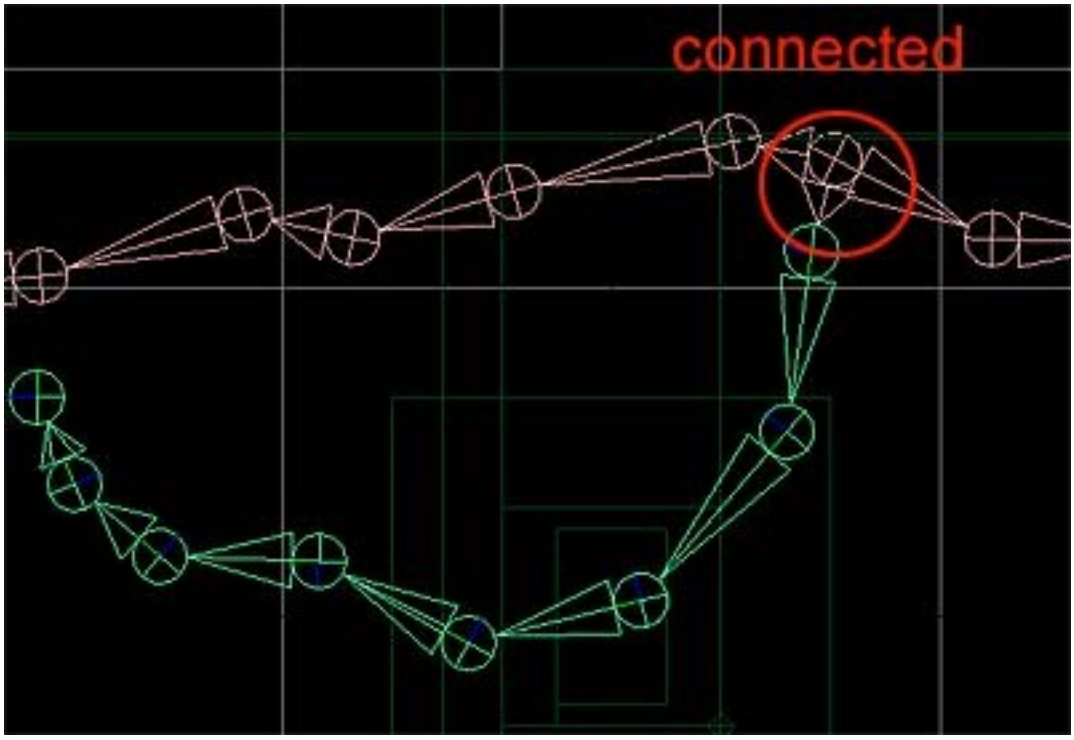
10. Go to front view to make sure the bones are at the center on the creature. If not, select the pelvis and press w to translate it. As you can see, by select only the pelvis joint, you will be able to move the whole bone structure; this is because pelvis joint stay at the top of the hierarchy. Get the idea?



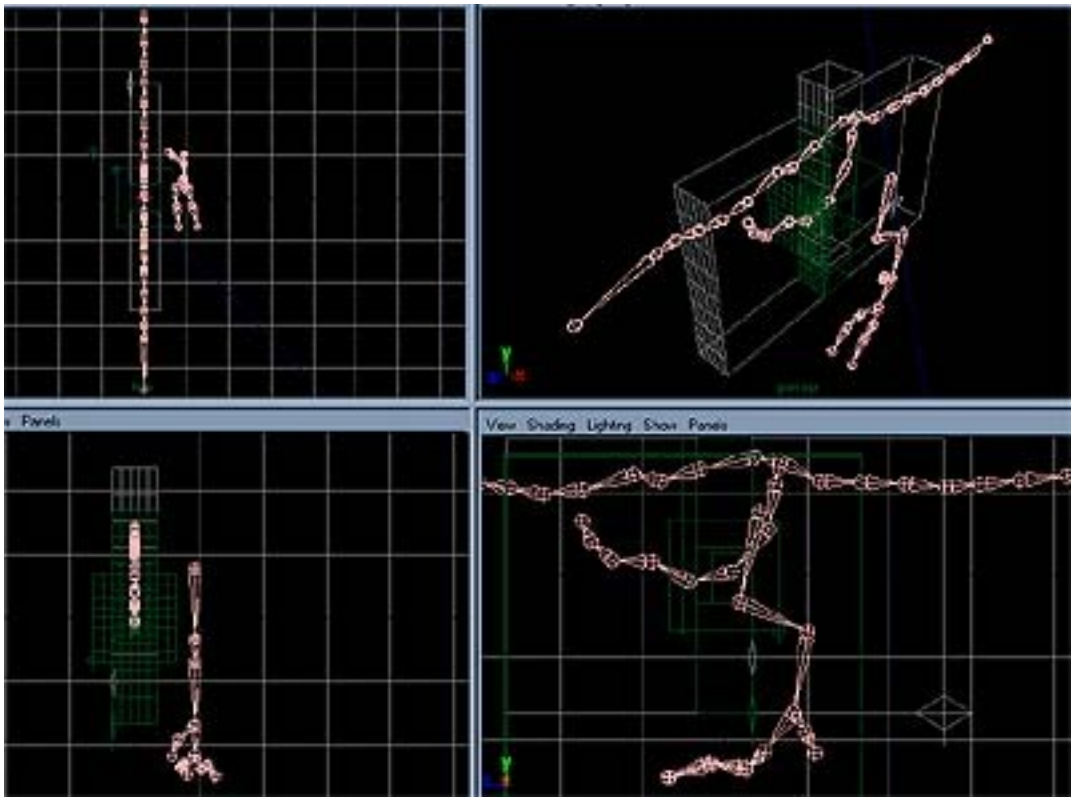
11. Ok, I will start create bones for it's torso.



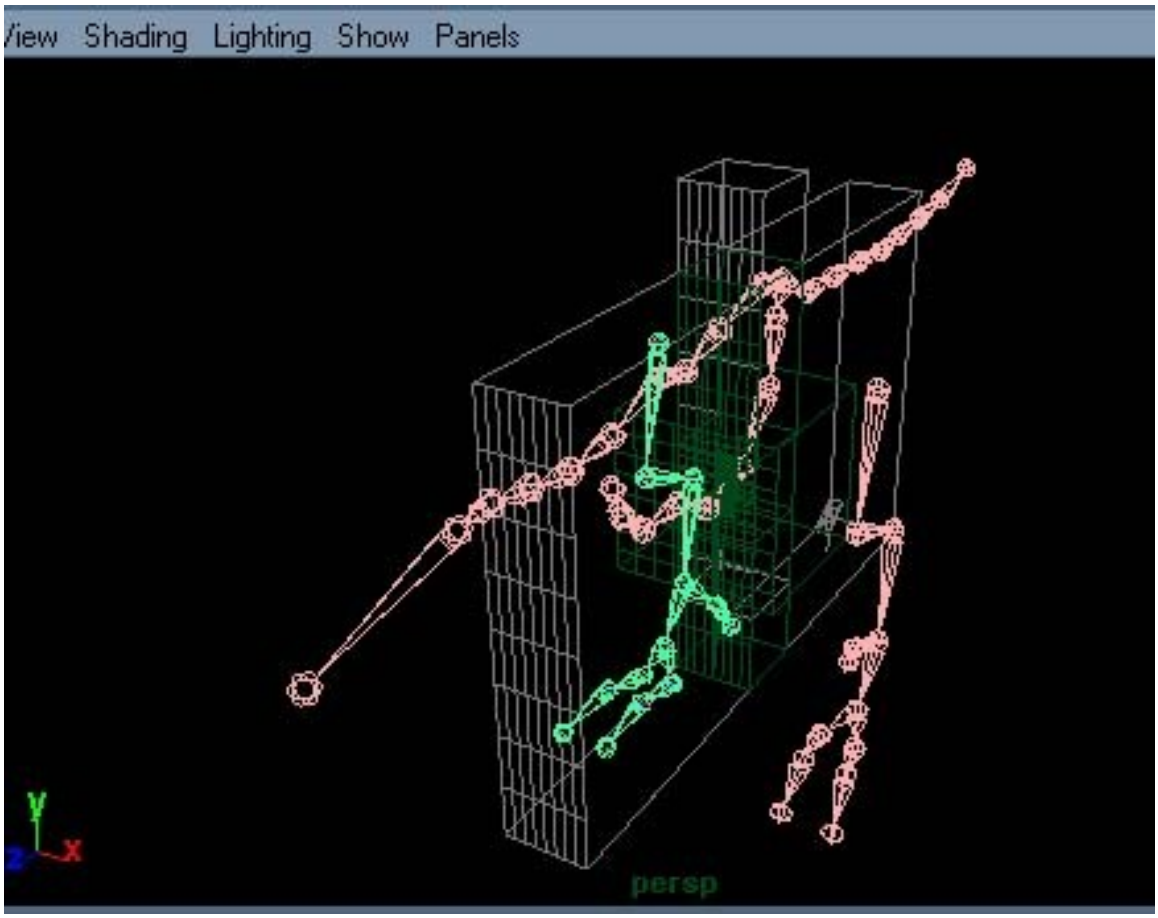
12. Parent the bones to pelvis joint.



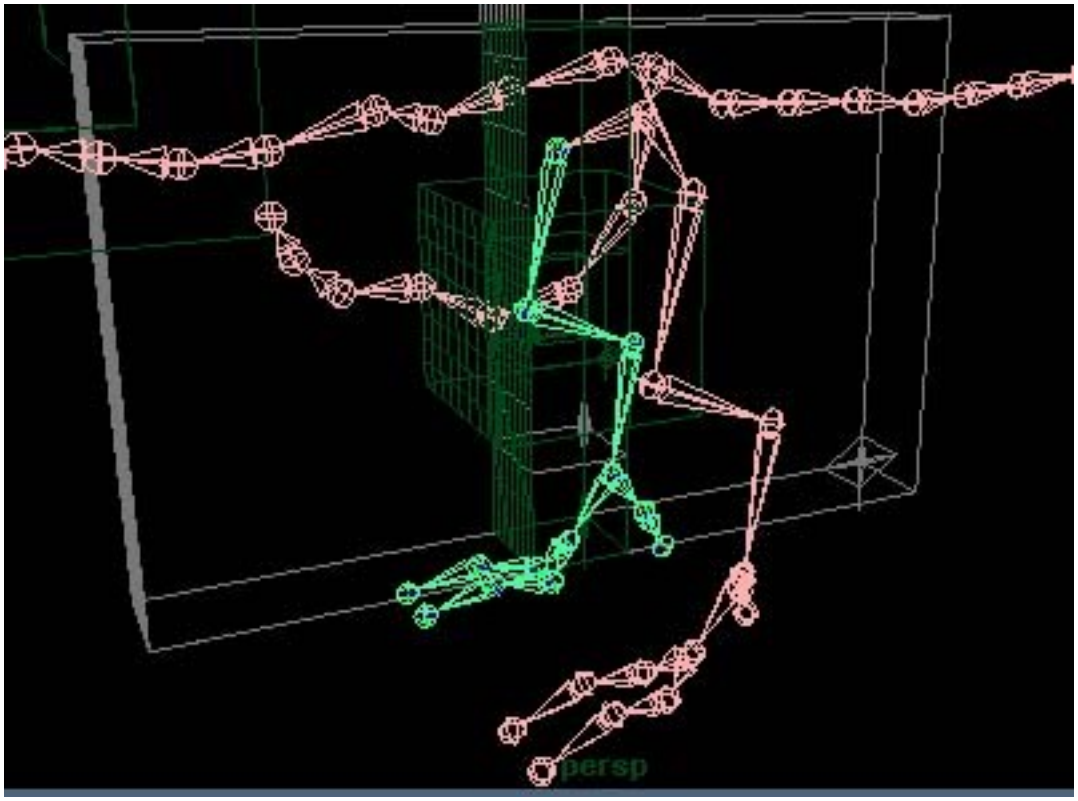
13. Using the same method to create it leg. Rename the joints to name like Lt_leg, knee, ankle, and toes. bra ..bra..bra any name you like. Position the left leg's bone structure to the correct location.



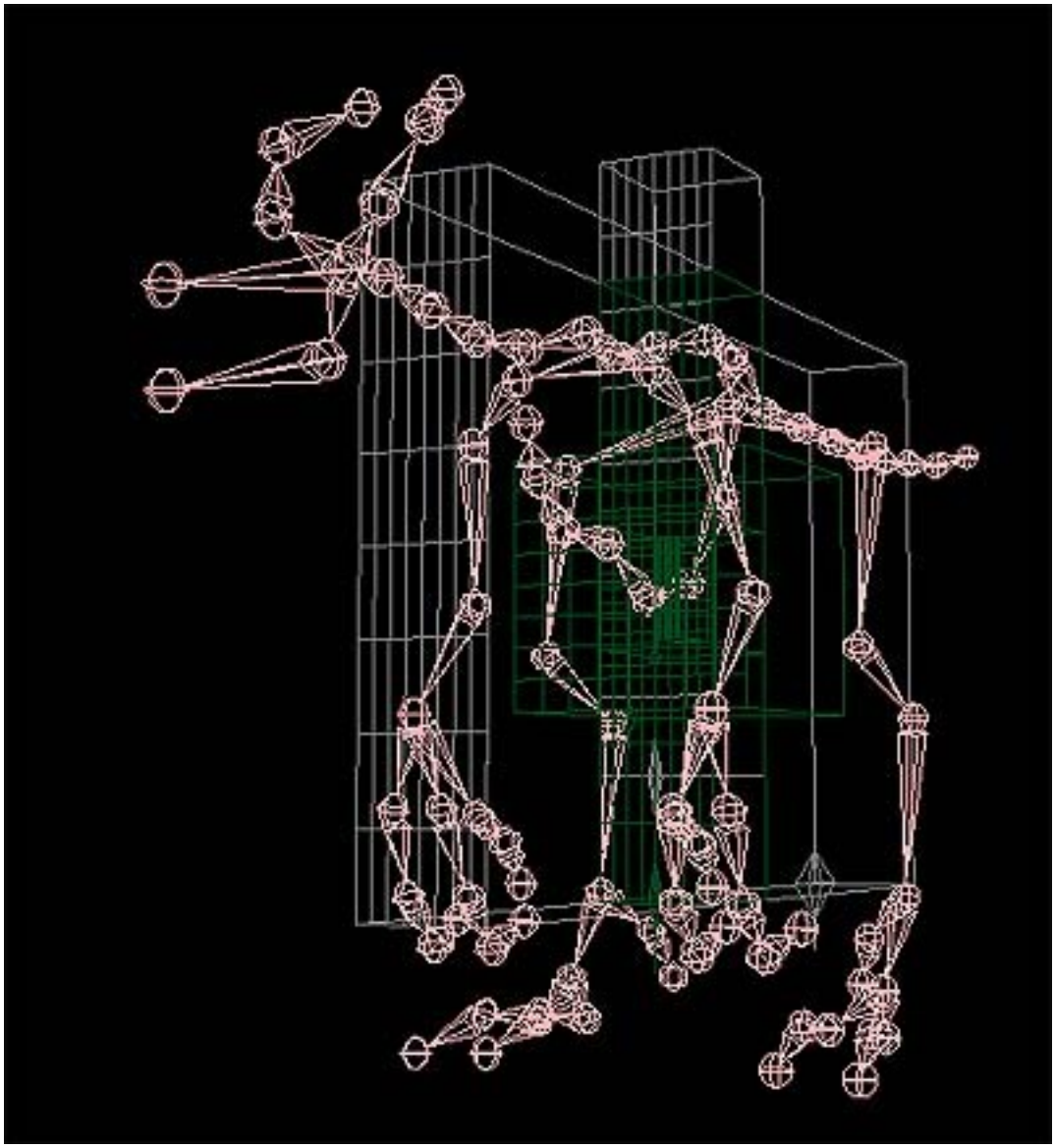
14. Mirror the left leg to right side by -> skeleton -> mirror joint option. In this case, I selected mirror across YZ.



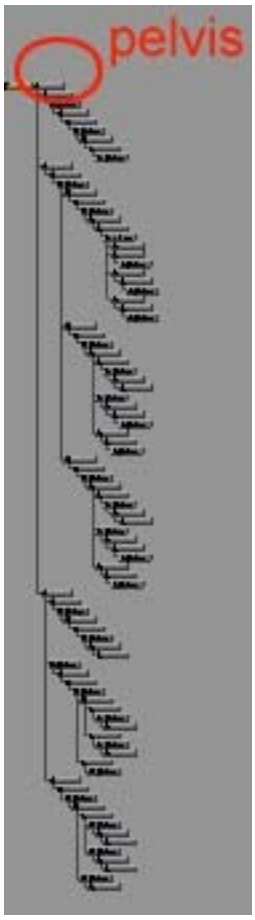
15. Then, I will parent the 2 legs to torso joint.



16. By using the same method, you should be able to complete the whole skeleton.

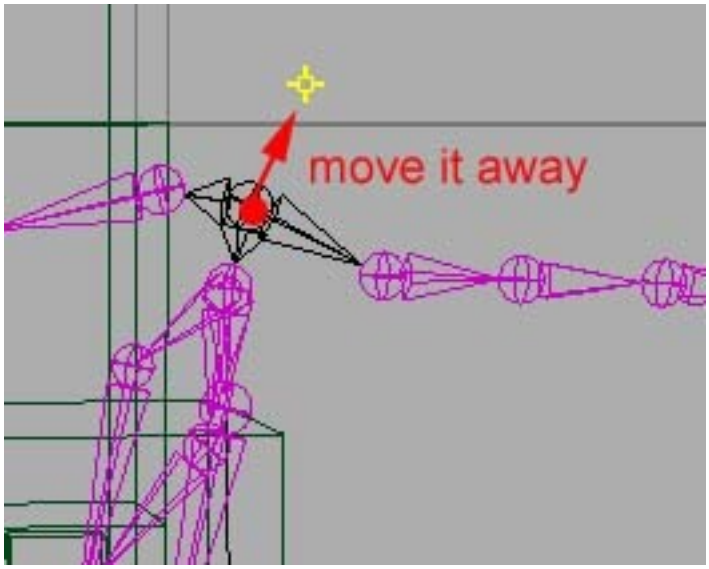


In your hypergraph, pelvis should at the top of the hierarchy.



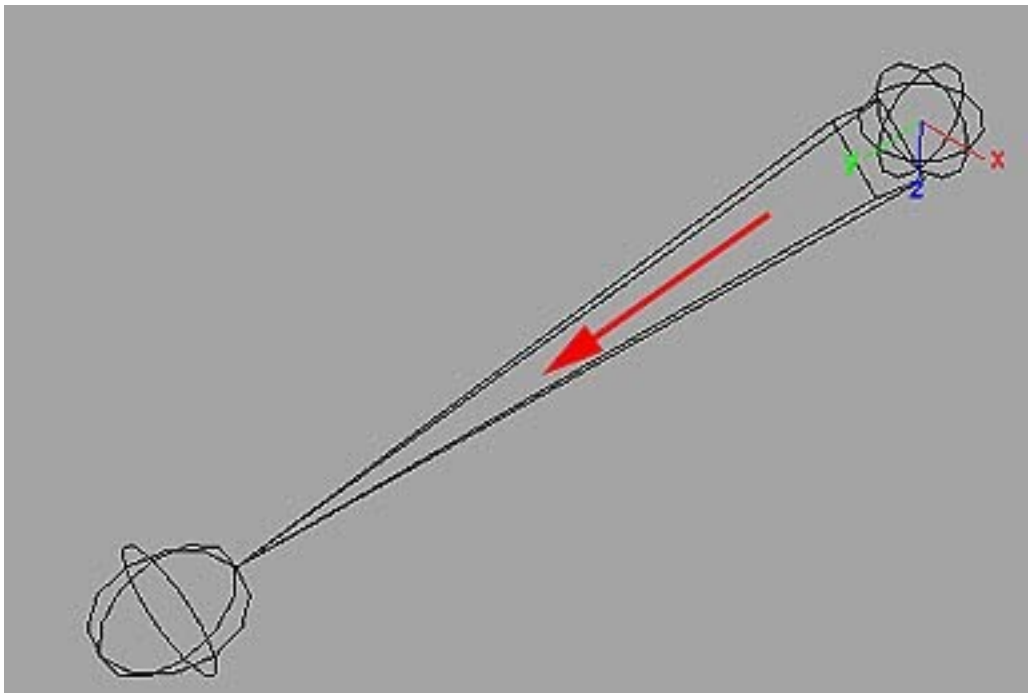
To make the pelvis joint more easy to select, I will select the pelvis joint and -> Display -> object component -> Selection Handles to display it's selection handle. Then, toggle to Select by Component mode, select +.

Then select pelvis's selection handle from pelvis joint, moves it away from the pelvis joint. When this done, we will be able to select pelvis joint easily.

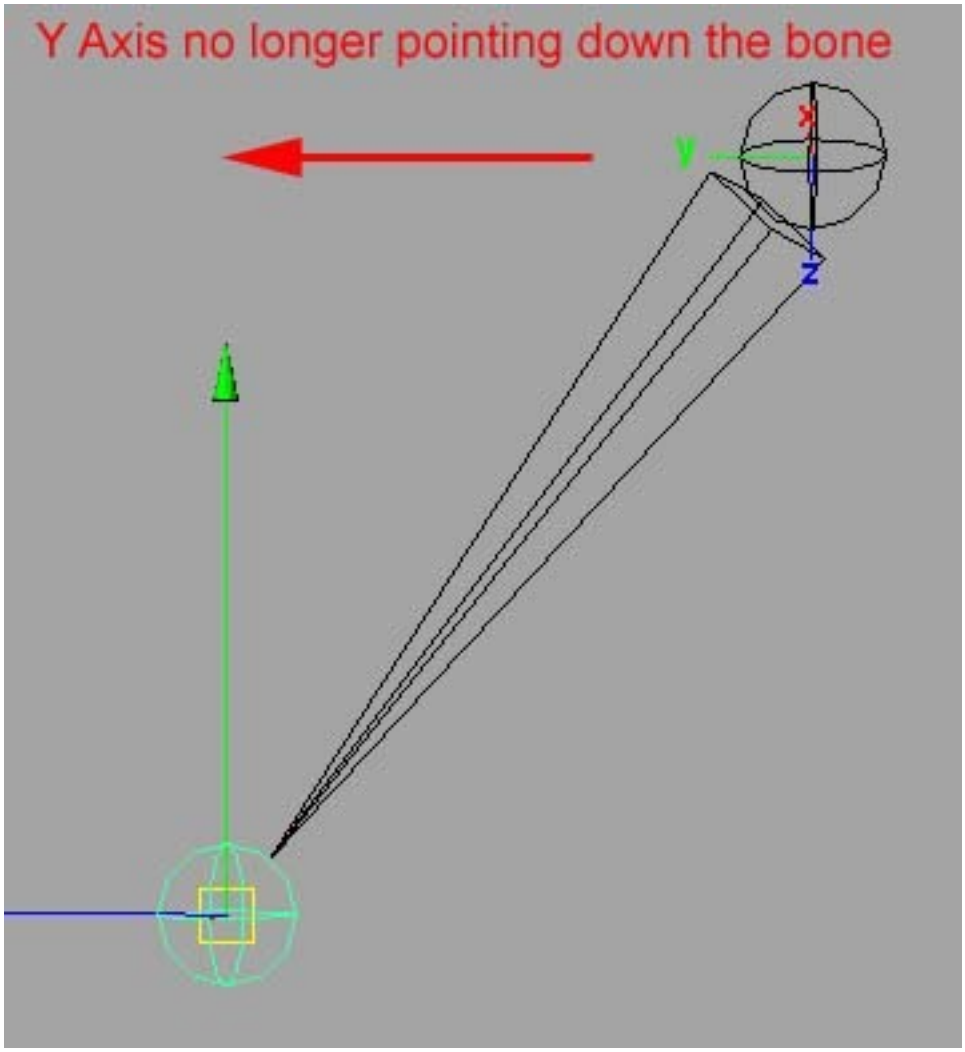


Reorienting Local Axes of Joints

To show joint's local rotate axes, select the joint, go to Display -> object components -> Local Rotation Axes

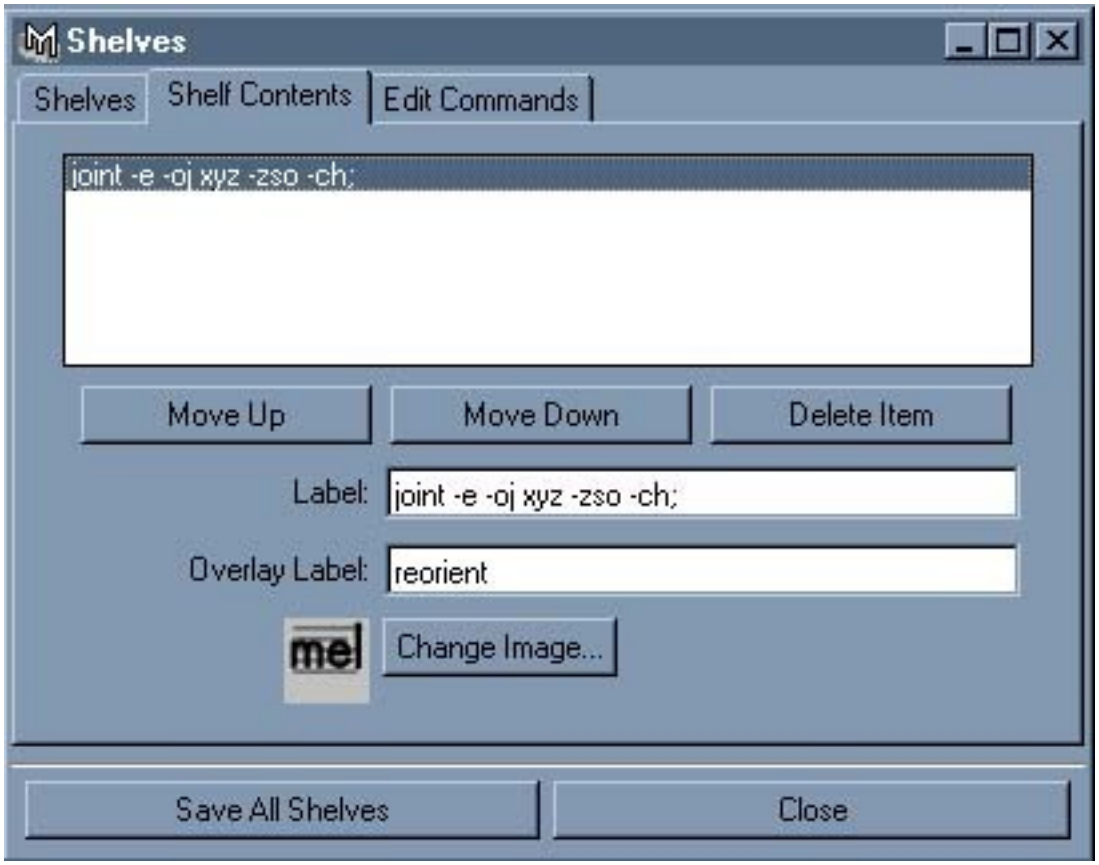


As you can see from the bone I've created with local rotation axes shown, Y-axis is pointing down the bone, This is what we want. But after we translate the joint to fit it into our model, Y axis will no longer pointing down the bone anymore, and this will mess up the joint's rotation, this is what we don't want.



So, we need to reorient the Y-axis. To do this, we need a MEL command to help us auto reorient the Y-axis.

Key this **joint -e -oj yxz -zso -ch;** in command window, you can edit **yxz** to **xyz** to suit your need. First alphabet is the axis that pointing down the bone. You may like to save this command in your shelf by MMB drag the script from command window to shelf.



We will use another Mel command **select -hi;** to help us to select all joints in hierarchy. Save these commands into your shelf, it's very useful.

1. Pick the pelvis joint and apply **select -hi;** to select all joints in hierarchy. Go to Display -> object components -> Local Rotation Axes to show all joints' rotation axes.

2. While the bone still selected, I applied **joint -e -oj yxz -zso -ch;** to reorient the joints. Check the joints' reorientation carefully, if everything ok switch off display local rotation axes. Now, I have our bones ready. Next, I will proceed to IK setup.

IK Setup

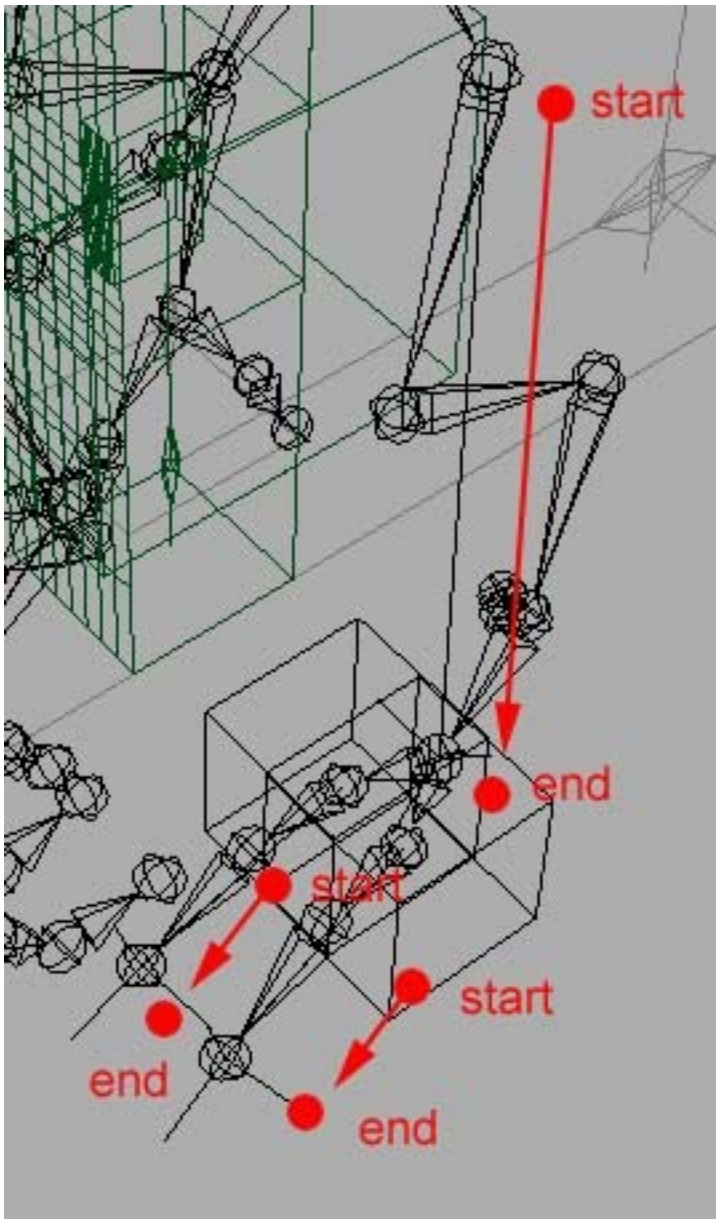
1. I will start with its left leg, for the leg joints, I turn off some joints axes' Degree of Freedom. To do this, select a joint and open it's Attribute Editor window (Ctrl-A). Do this to the joint that you think has only one or two rotate axes

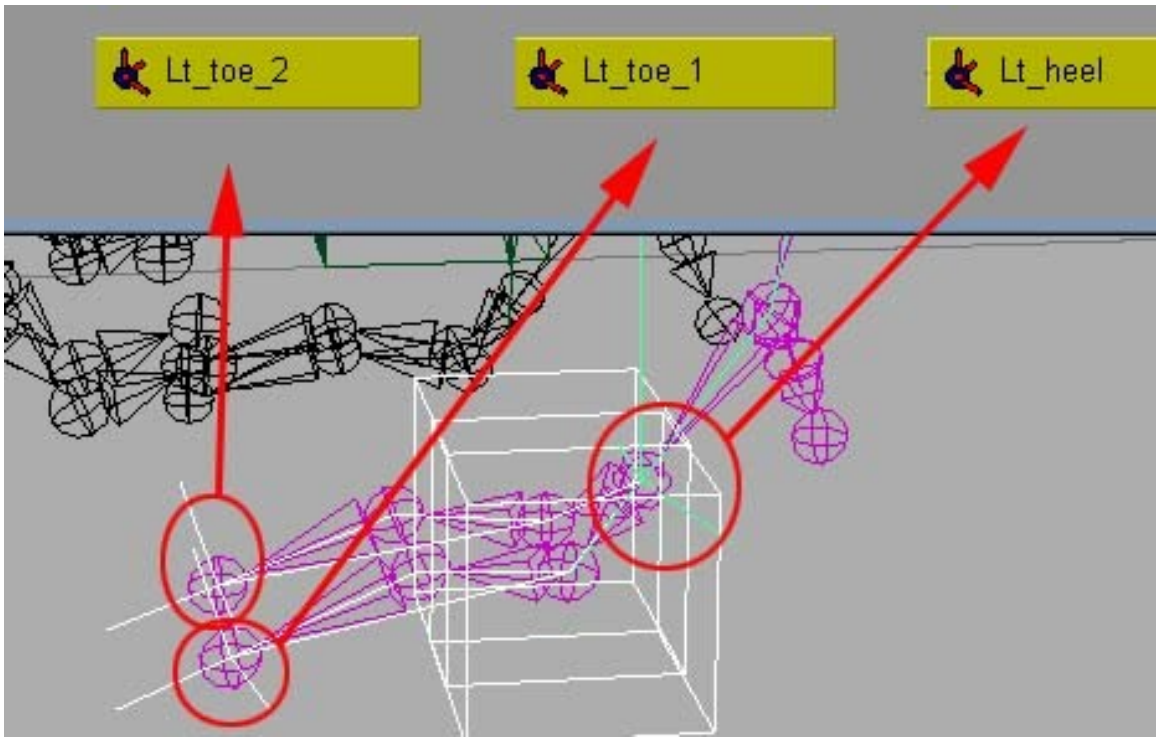
2. Then, I will proceed to create IK. Select the IK tool: skeleton -> IK handle tool or select from the shelf.

From the IK Handle tool option, switch the Current Solver to ikSCsolver.

3. With the tool still selected, I clicked on the left leg's joints that I wish to apply with IK.

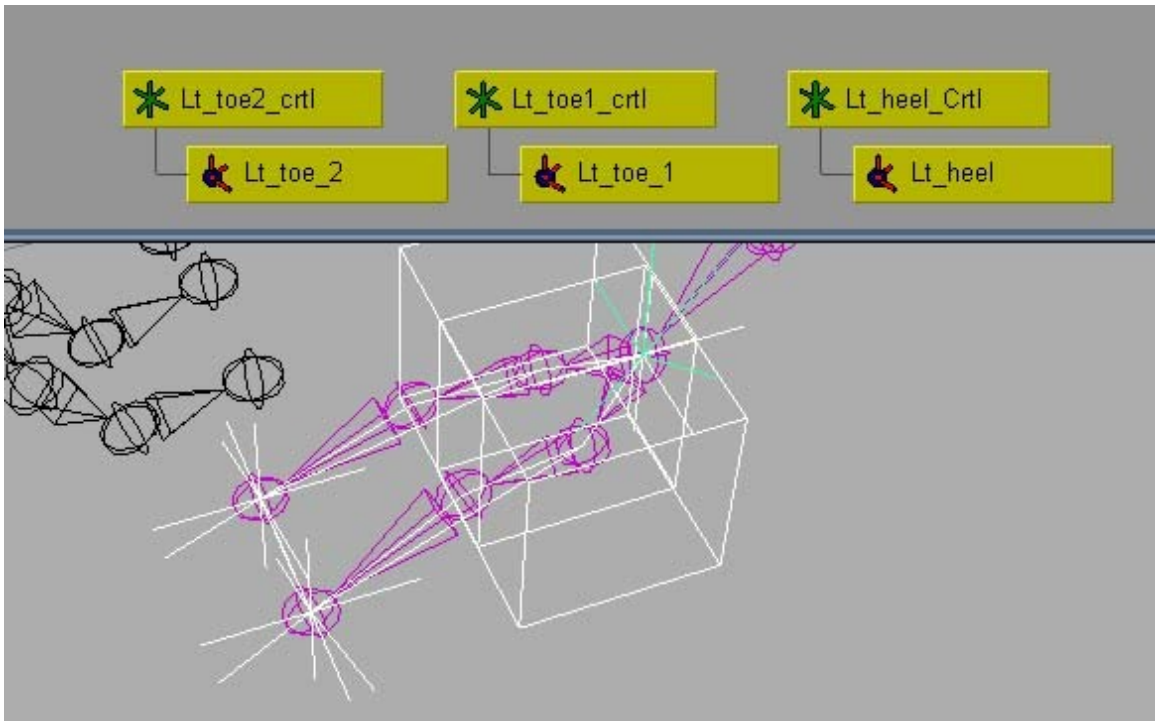
4. You will find an IK handle node in your hypergraph. Rename it. Press Y to return to previous tool, then I create IK handles for both of the toes. There are total 3 IK handles I created for left leg.





You can start move around with the IK handles to see how IK works with your bone. Undo the translation to get it back to position before moved. O.K, now select the pelvis joint, translate it, you may find that the left foot was moved with it. We would like it to stay on the ground. To do this, we need to add locators to control it.

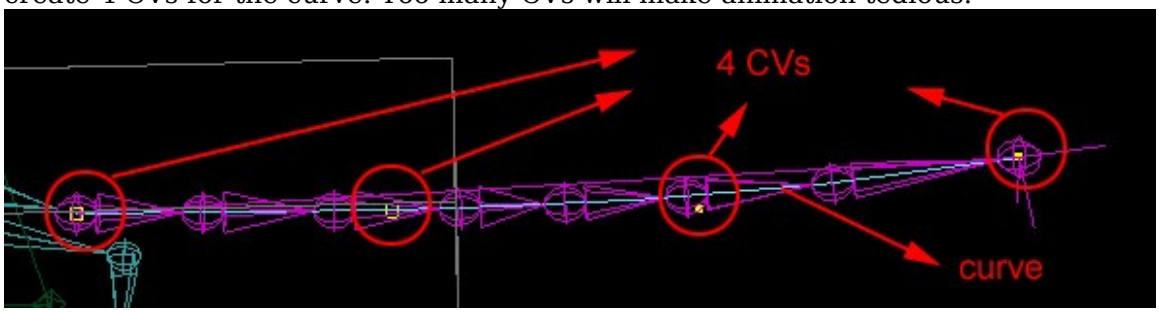
5. Create a locator and holds down V key to activate point snapping, then MMB drag the locator to heel joint. Then create another 2 locator, using the same way to place it to locations of toe1 and toe 2. Rename the locators. Then parent the locator to its IK Handle.



Now I will select the pelvis to move around, the left foot be stay on the ground.

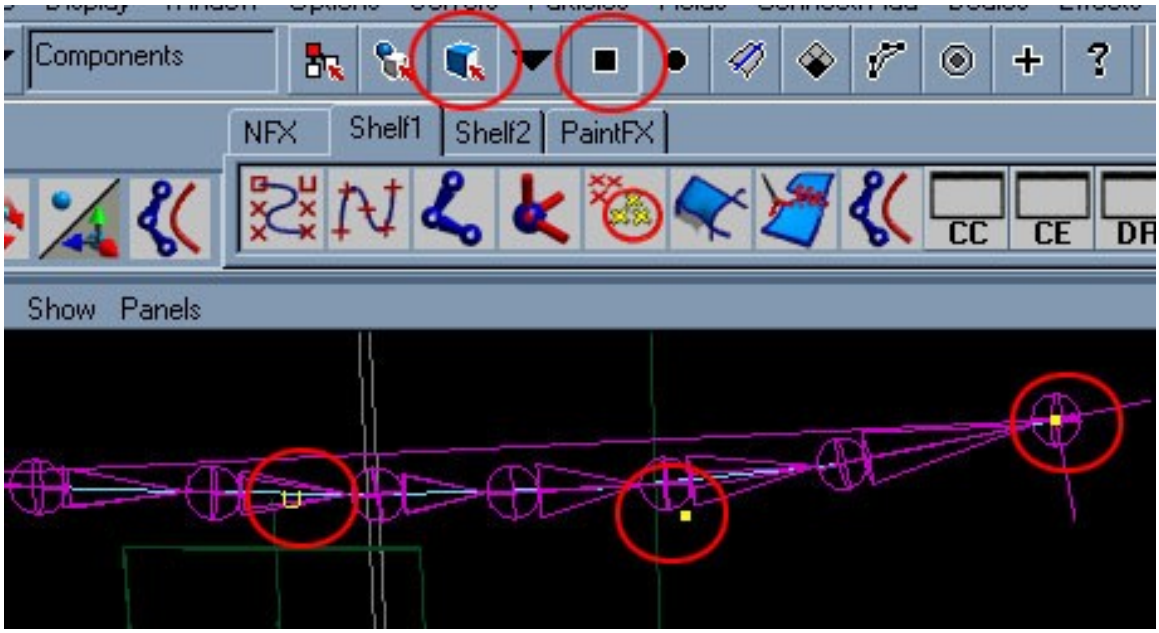
6. Using the same method to apply IK to right leg.
7. I will use spine IK for its tail. This tool is great for joints like – tails, antennae, snake etc.

Go to Skeleton -> IK Spine Handle Tool's option, number of span set to 1. This will create 4 CVs for the curve. Too many CVs will make animation tedious.

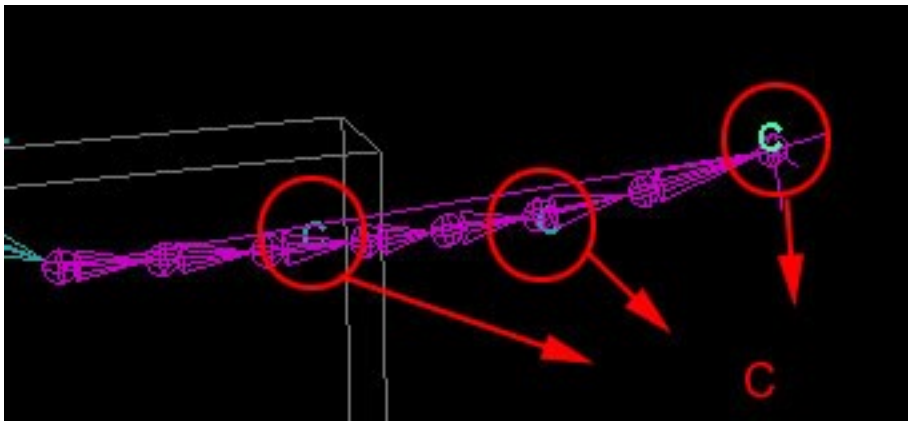


After spine IK was made, Maya will create a curve that allow you to control the motion of the tail.
In Pick Mask's select by object type, toggle on Select by Type: Curve to select the curve, then right click and hold, select CV from the hot box.

Then, switch your Pick Mask to Select by Component Type: Points. Select the curve's CVs
I will only select from 2nd CV onward because 1st CV is the root. Later on, I will parent them to locators to make this CVs easy to select.



7. Select 2nd CV and go to deform -> create cluster's option, select relative then create. You will find out CV has a C beside. Do the same to 3rd and 4th CV.

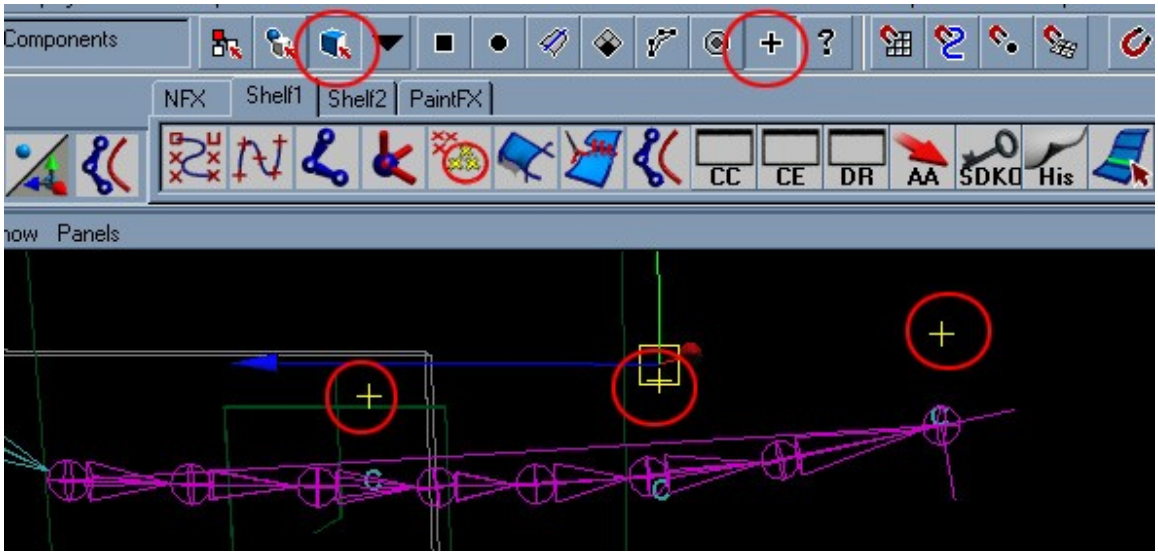


In Hypergraph, you may notice cluster nodes have been created.

Then I will display clusters' selection handle to make them easy to be selected.

8. Select clusters then -> Display -> object components -> selection handles

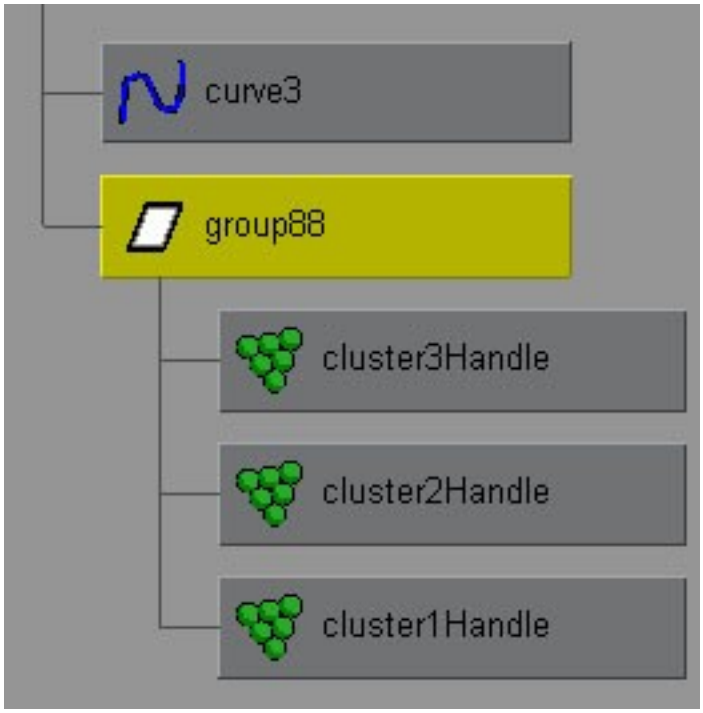
Toggle Pick Mask to Select by Component type: Handles, the select the clusters in window. You may notice + (selection handle) have turned to yellow. Move them away from joints (visible location)



Now switch to Select by Object type: handles, and select the clusters' handles, try to move them.

This setup will save us some time when we want animate it in future.

Select the Pelvis joint and move it forward, Cluster handles are not following. To modify it,
Groups the cluster handles together and select the group, parent it to pelvis. Now select the Pelvis joint and move it again. Cluster handles are following.

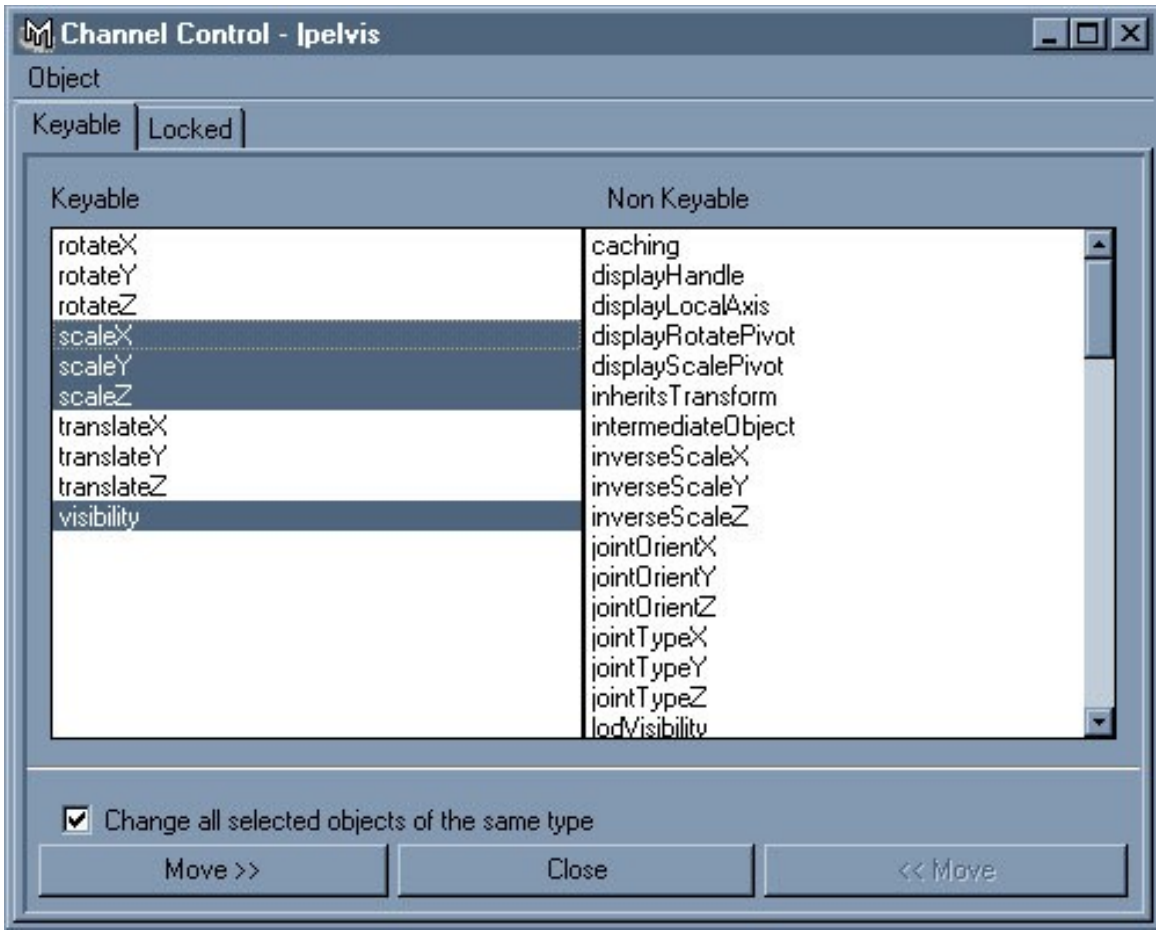


O.K, we have finished spine IK setup for tail. It's up to you whether you want to use IK or FK for its arms.

Adding Attributes

I would like to use Add Attribute feature to create new attributes to my setup and use Set Driven Key to control them. Before I start, I will do some clean up works.

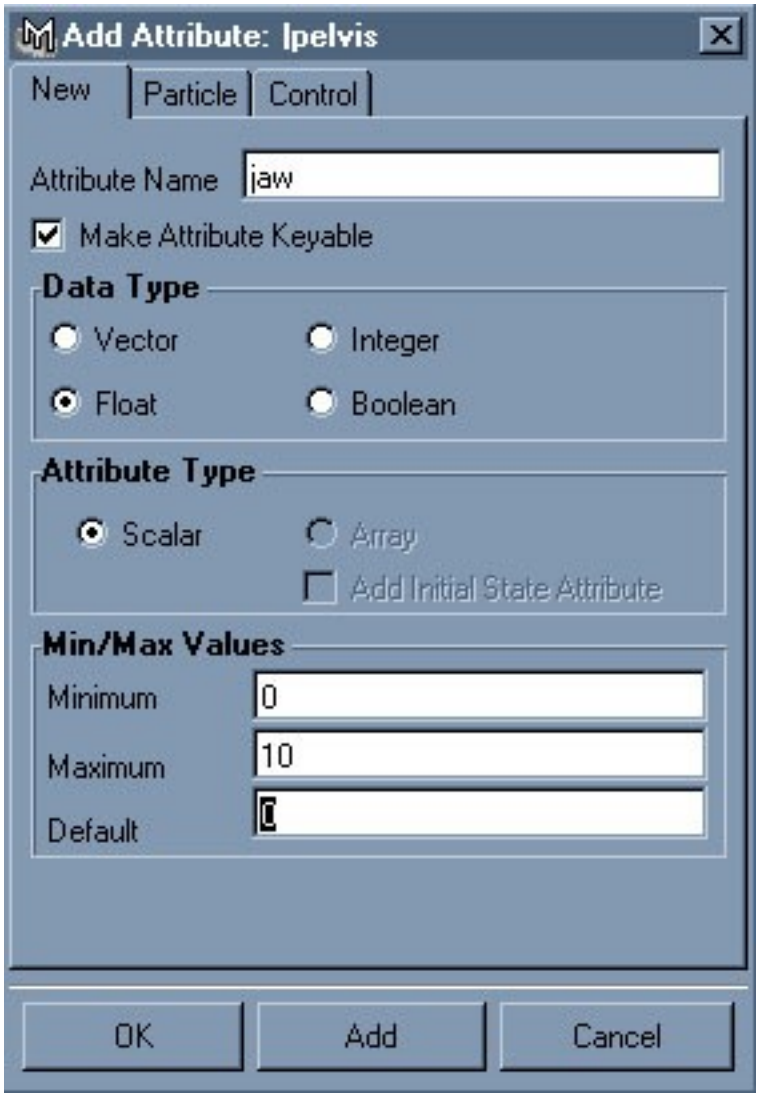
1. Select pelvis joint and go to Window -> General Editor -> Channel Control.



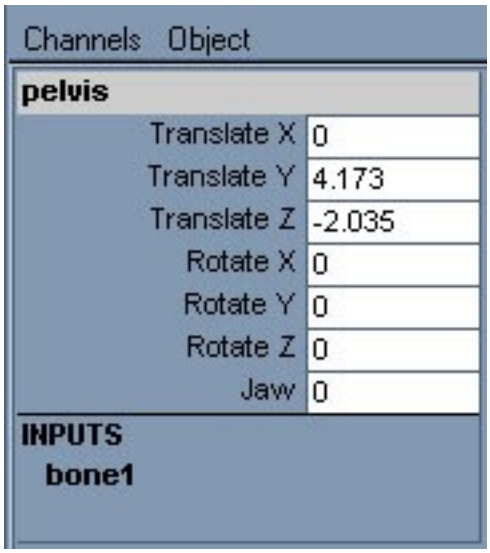
Highlight the channel that you don't want to be key, click Move >> to make them non-keyable.

2. Go to Modify-> Add Attribute to bring up it's window.

I named the attribute name to Jaw, Data Type set to Float, Minimum=0, Maximum=10, Default=0. Then O.K.



3. Now we have got Jaw's attribute in Channel Box. New attribute has been added to pelvis joint.

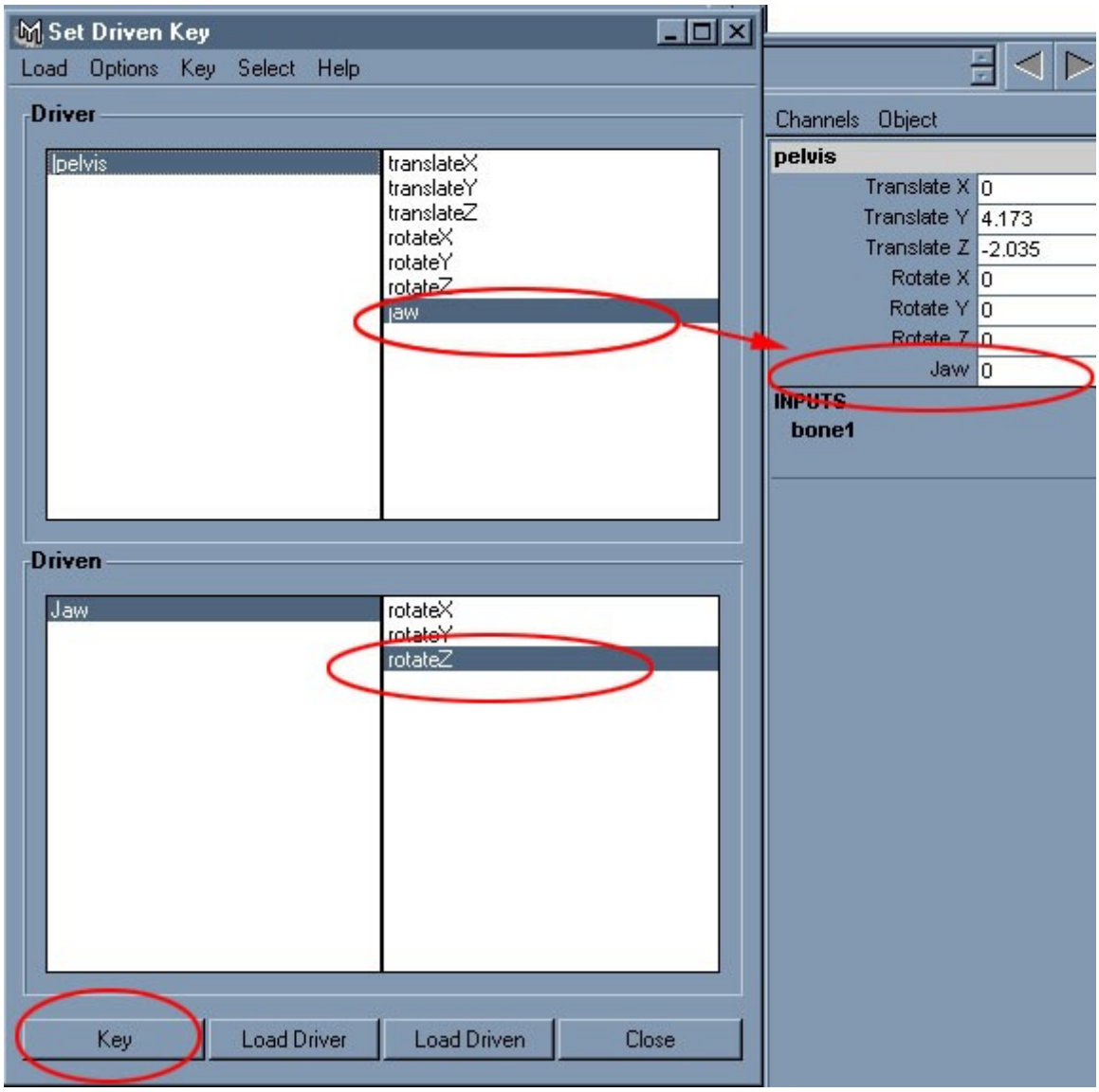


I will use Set Driven Key to connect Jaw's attribute.

Set Driven Key

Set Driven Key (SDK) is very powerful and it allowed you to have a node's attribute drive the attribute of another node. It's very useful for animation.

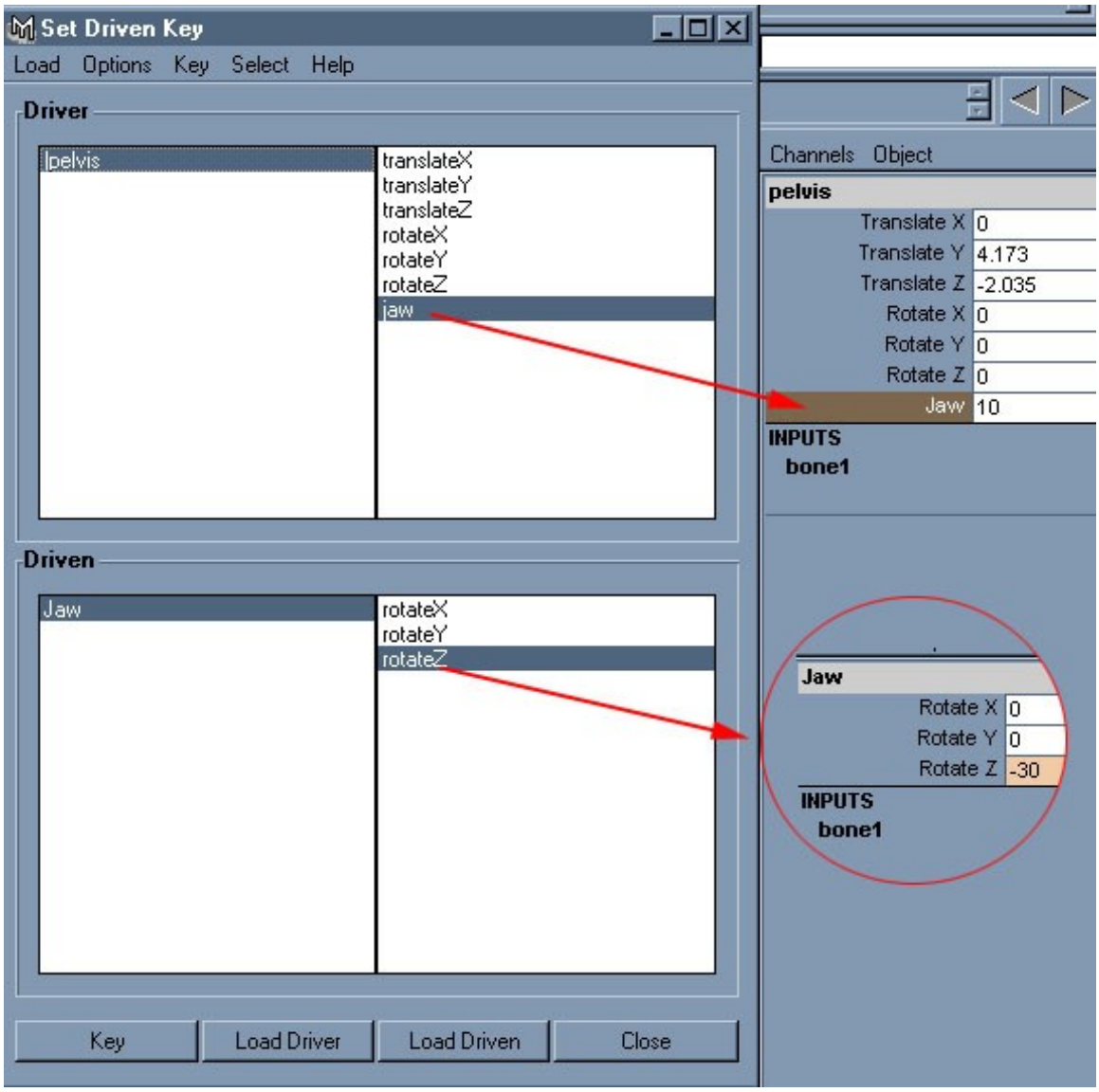
1. While the pelvis still selected, go to Animate -> Set Driven Key -> Set option to bring up the Set Driven Key window.
Load pelvis joint as Driver, then select Jaw joint and load as Driven. Next, select Jaw from pelvis joint and rotate Z from Jaw joint. Make sure that pelvis joint's Jaw attribute and Jaw joint's attribute set to 0, then click on Key.



Jaw's value 0 (Min) has been set. Then I will set Jaw's value 10 (Max).

2. Key 10 for pelvis joint's Jaw attribute value, then –30 for Jaw joint's Rotate Z value. Click on Key.

Close the window and we have done.



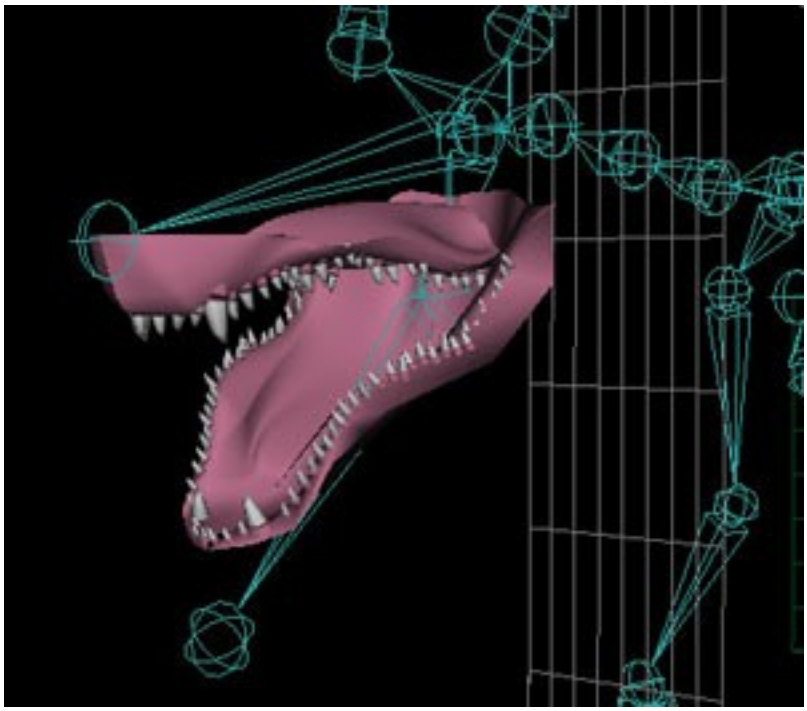
Now, Let's test the Jaw attribute. With the Jaw attribute selected in pelvis joint, MMB click on the perspective window and drag it right to left and you will notice the jaw is open gradually.

This is only a simple example of how to connect a node's attribute drive the attribute of another node.

You may want to add other attributes to drive other node according to your setup.

Binding Character Geometry to Skeleton

Before I start skinning the dragon, I will parent its teeth and gum to respective joints. This is because there are no deformation needed for teeth and gum.



Hide the teeth and gum geometry after parented to joints.

There are 2 methods of skinning: Rigid Skinning and Smooth Skinning both involve the assignment of points on the surface geometry to joints in the skeleton. In this case, I would like to use Smooth Skinning to bind the dragon.

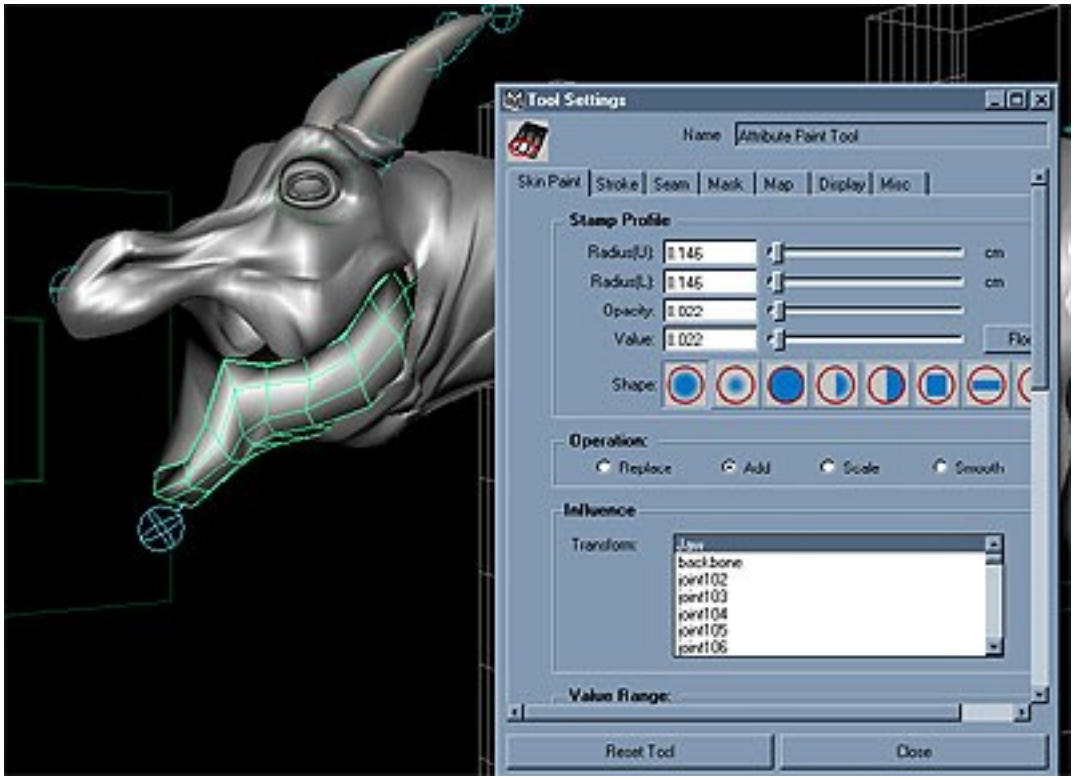
1. Before we start, I want to clear all the histories in geometry; this will avoid unexpected deformations.

Select all geomatries (except teeth and gum) and go to Edit -> Delete All by Type -> History.

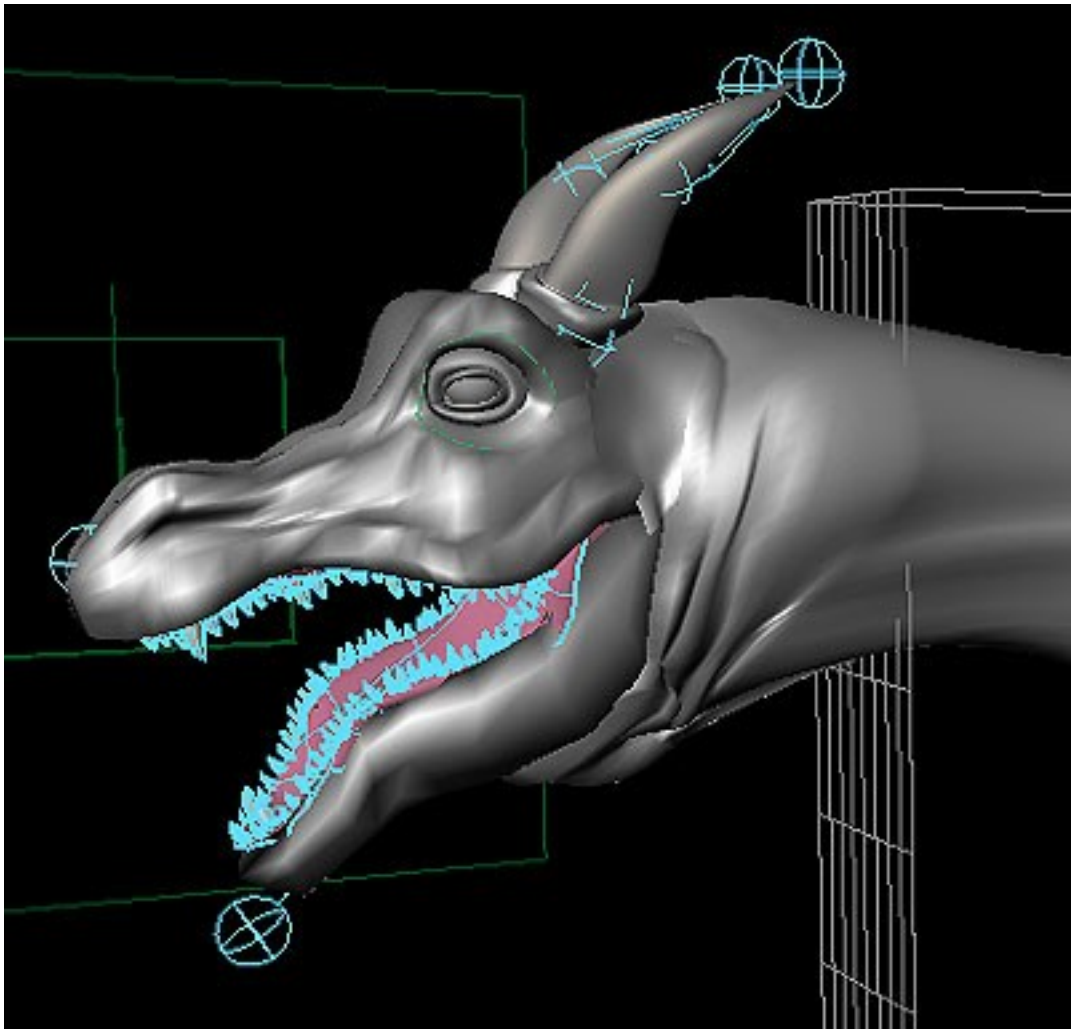
2. With the geometry still selected, Shift-select the pelvis joint's selection handle to select the whole dragon skeleton hierarchy. Then choose Skin -> Bind Skin ->Smooth Skin option.
   Bind to: Complete Skeleton
   Bind Method: Closest Joint
   Max influences: 2
   Dropoff Rate: 4

Then click on Bind

3. Select joints and move them around to see whether the skin behaves correctly or not. Then undo.



From the picture above, I need to fix it by refining the weight of the Smooth Skin bind. I will use the Paint Smooth Skin Weight tool. Skin ->Edit Smooth Skin ->Paint Skin Weight option to bring up the Tool Settings window, then paint weight values onto the different surfaces.
You can always place the character back to its original pose by Go to Bind Pose. Go to Bind Pose did not work if you translate the IK handle.
Select the geometry that you wish to paint weight, from the Tool settings window's Influences section, select the respective joint name, adjust the Stamp Profile value and start paint weight.



Basically, this is the method that I used to setup my character. You might need other methods to setup you character depend on how you want you character to be animated.